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Kestrel Voltage Limiter

Type 0602

**User Manual
Revision 1.0 (04-08)**



For the following models of Type 0602 Voltage Limiter

Type 0602-600-245
Type 0602-600-135

245Vdc 600W
135Vdc 600W

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Disclaimer

Kestrel Wind Turbines makes every effort to give accurate information in this manual and is in no way liable for any error or omission. The user of this manual assumes full responsibility and risk.

We appeal to your common sense to read and apply the safety notes. Consult professional engineers and take advice if you are unsure.

1 SAFETY FIRST

1 Safety Considerations
1.1 Mechanical Safety
1.2 Electrical Safety
1.3 Installation Hazards
1.4 Operational Safety

Although Kestrel Voltage Limiters are designed with your safety in mind, accidents can easily occur and there are always inherent dangers associated with any type of machine. **Consult installation professionals if you lack experience or confidence.**

1.1 Mechanical Safety

Use good handling methods and take precautions to avoid physical injury during installation and maintenance/repair procedures. Be responsible when using all tools whether manual or powered.

1.2 Electrical Safety

Read and adhere to the installation instructions for this product. Do not work on the system when the wind turbine is running or when lightning is possible.

Disconnecting and re-connecting wires may cause a spark and the presence of explosive hydrogen from battery charging is always a possibility. **Adequate ventilation must be provided for battery installations.** The wire size used for connections must be correct for the powers supplied. The smaller the wire diameter, the higher the wire losses and therefore the heat generated in the wire. **Use correct wire sizes throughout the installation.** The amount of energy stored in a battery is considerable and fire can result from shorts. **Fit a suitable fuse or circuit breaker in the battery cable.** In general, respect the system and use common sense. Consult a qualified electrician if you are unsure.

1.3 Installation Hazards

Be sure to read and adhere to the installation instructions for this product. Always work carefully and have an assistant wherever possible. Always re-check the work as you progress. Slack bolts, poor workmanship and loose electrical connections must be avoided.

1.4 Operational Safety

Be aware that the voltage limiter will become hot during certain operation modes. This is quite normal but be aware of high temperatures on the rear heatsink. System checks are best carried out in calm weather conditions. Avoid any maintenance or inspection during windy weather. Be aware that internal voltages can cause a shock.

2 VOLTAGE LIMITER OVERVIEW

2.1 Voltage Limiter Description

- 2 Voltage Limiter Overview
- 2.1 Voltage Limiter Description
- 2.2 Identification and Markings
- 2.3 Application and Uses

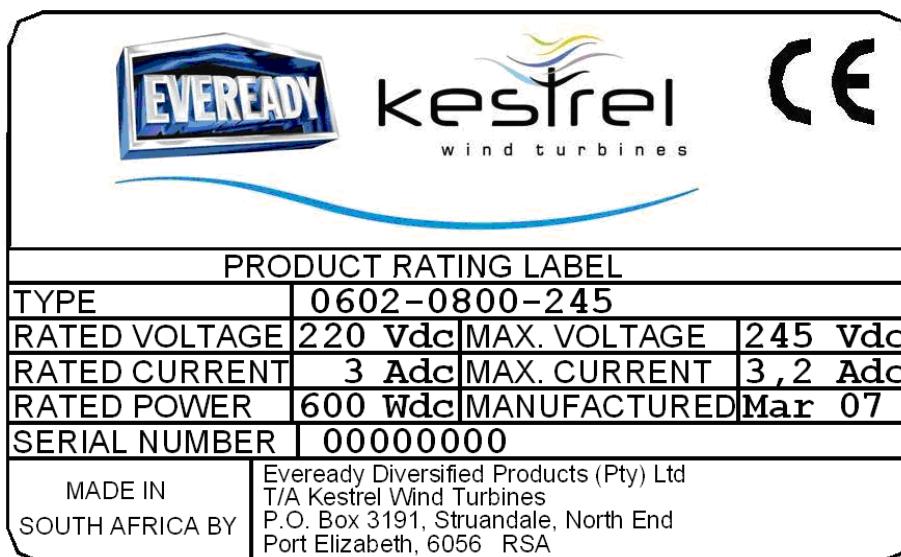
IMPORTANT: This product is not designed to be used on a Kestrel Battery-charging system. The Voltage Limiter is solely to restrict the output voltage of a Kestrel wind turbine in Grid Tie applications and hybrid applications using an Outback MX60.

Sustainable/renewable energy sources such as wind turbines and hydro-generators are often connected to a charge controller or a Grid Tie inverter. Such components can exhibit operational modes that reduce the demand or disconnect the system from the generator. Any operational generator or alternator will exhibit high output voltages when no output is demanded.

The Kestrel Type 0602 Voltage Limiter uses electronic means to restrict the incoming voltage at a pre-designed value. The product uses linear technology causing no electrical disturbance during operation. This quality is paramount when powering any communication or computer equipment. The Voltage Limiter is passive and uses no energy whatsoever during normal operation. If for any reason the generator voltage rises, the limiter restricts this voltage rise to a preset value. It achieves this limiting by loading the generator. The product is housed in a steel enclosure for wall mounting. It is extremely reliable in operation and incorporates a failsafe design. Unit cooling is achieved by convection and three assisting fans.

2.2 Identification and Markings

On the front cover reveals the product rating plate; if the Voltage Limiter does not carry this stamp it does not carry a Kestrel warranty and may not be authentic.



*NOTE: Product Rating label example (above) is for format only, specifications do not apply

2.3 Applications and Uses

The Kestrel Voltage Limiter Type 0602 is primarily intended for use with the e150 (600W) Kestrel wind turbine that has either been installed with an in-line battery charge controller such as the Outback MX60 or a Grid Tie inverter. Each application may require specific additional electrical equipment. Consult the manuals supplied with this equipment. **The product is available for 245Vdc and 135Vdc.**

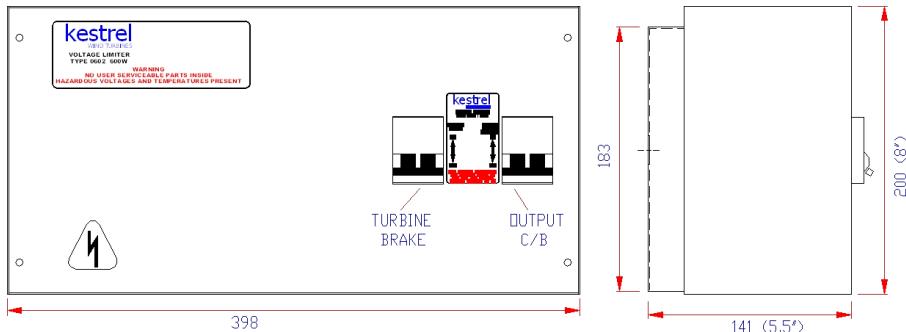
3 VOLTAGE LIMITER ASSEMBLY

- 3 Voltage Limiter Assembly
- 3.1 Components Supplied
- 3.2 Components Not Supplied
- 3.3 Tools Required
- 3.4 Unpacking

3.1 Components Supplied

The following components are supplied:

- Voltage Limiter assembly



3.2 Components Not Supplied

The following components are necessary to complete an installation:

- Electrical crimp terminals
- Wall fixing screws or bolts
- 20mm cable glands

3.3 Tools Required

The following hand tools are required for the charge controller installation:

- Small size electrical screwdriver
- Medium size electrical screwdriver
- Wire strippers for electrical connections
- Electrical crimping pliers
- Tape measure for positioning
- Electrical Drill for Fixing

3.4 Unpacking

Open the packaging container and check for any transit damage. The parts contained are listed in section 3.1 and on the included packing slip. Lay out and identify the parts.

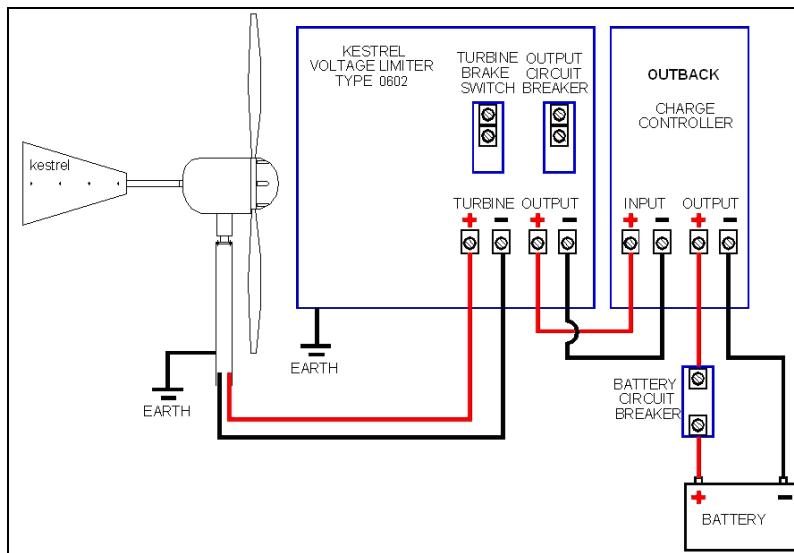
4 INSTALLATION INSTRUCTIONS

4 Installation Instructions

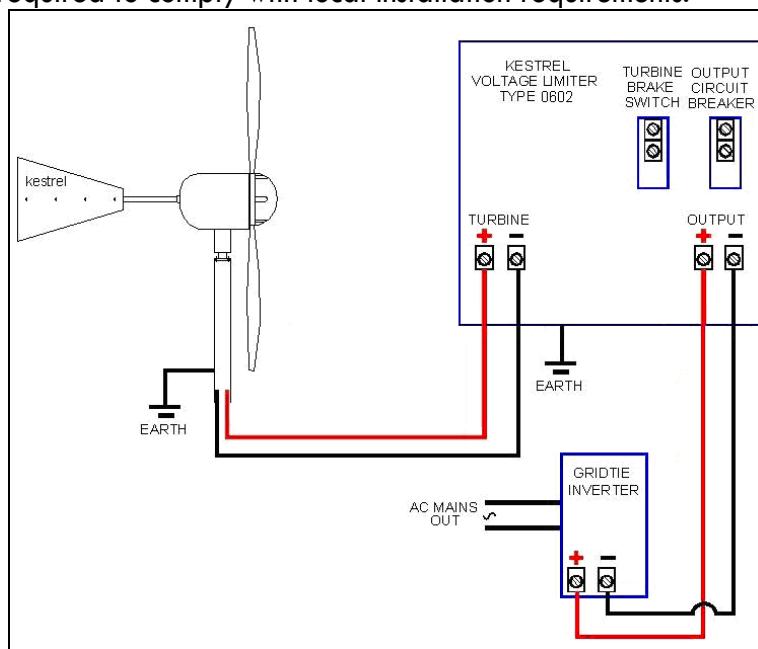
- 4.1 Typical Installation Example
- 4.2 Mounting the Voltage Limiter
- 4.3 Electrical Wiring
- 4.4 Securing the Voltage Limiter

4.1 Typical Installation Example

A typical battery charging installation is shown below. The system comprises an e150 (600W) Kestrel wind turbine, voltage limiter, alternative charge controller and storage battery. Note that other electrical equipment will be required to comply with local installation requirements.



A typical Grid Tie installation is shown below. The system comprises an e150 (600W) Kestrel wind turbine, voltage limiter and an alternative manufacture Grid Tie inverter. Note that other electrical equipment will be required to comply with local installation requirements.



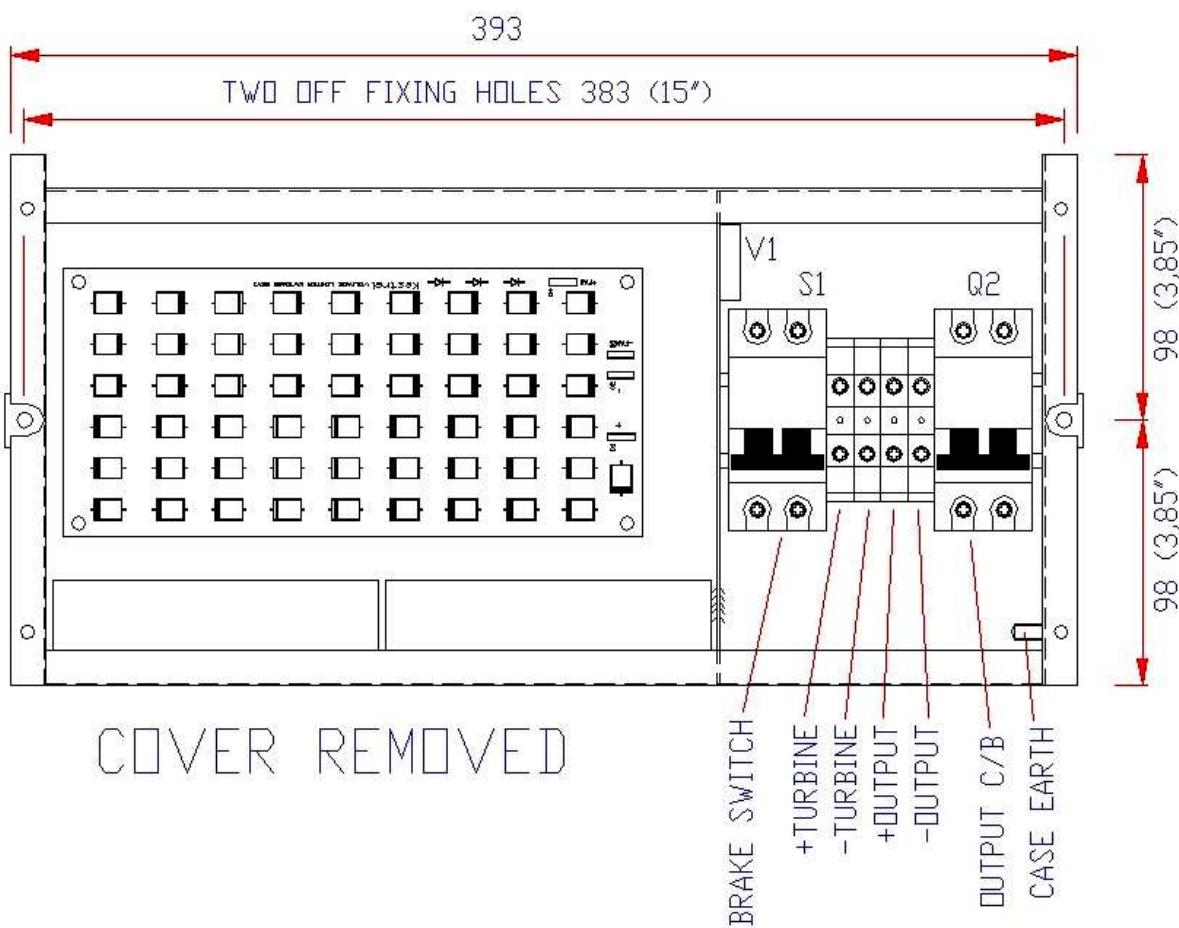
6

Consult the Grid Tie inverter and charge controller manuals for full installation procedures.

4.2 Mounting the Voltage Limiter

The Kestrel Voltage Limiter Type 0602 is suitable for outdoor or indoor installation. The unit must be vertically mounted using the four external fixing holes provided. Use secure fastening with suitable wall plugs or bolts. Allow a minimum of 100mm (4") space all around the unit for cooling. It is normal for the voltage limiter to become quite hot at times as it dissipates unwanted energy.

Do not place any objects on the top of the enclosure. The unit relies on the free passage of air through the enclosure for cooling.



NOTE: The Voltage Limiter uses cooling fans. Make sure that the bottom air entry is kept free of obstructions. Unit cooling relies on the free passage of air through the cabinet.

4.3 Electrical Wiring

Observe the Polarity at all times. Only connect +VE RED cables to +VE RED terminals and -VE BLACK cables to -VE BLACK terminals. Otherwise, equipment damage may result and any warranty will be invalidated.

PLEASE FOLLOW THE INSTRUCTIONS BELOW !
CONSULT SECTION 5 FOR WIRE SIZE RECOMMENDATIONS

The Voltage Limiter is provided with two pairs of +VE and -VE clearly marked terminals for "TURBINE" and "OUTPUT" at the bottom of the regulator. The TURBINE BRAKE switch is designated "S1" and the OUTPUT CIRCUIT BREAKER is designated "Q1". The turbine brake switch stops the turbine by creating an electrical short on the turbine input. When operated, this prevents high turbine open circuit voltages being developed.

The wind turbine should not be rotating during this installation. If turbine access is not possible, short the two turbine power wires together. Observe the Polarity at all times. Only connect +VE RED cables to +VE RED terminals and -VE BLACK cables to -VE BLACK terminals.

- a) Arrange the wires from the turbine and the battery ready for connection.
- b) Check that the turbine wires are shorted. Check that the output wires are isolated from the charge controller or Grid Tie inverter.
- c) Check that the Voltage Limiter OUTPUT CIRCUIT BREAKER (Q1) is switched OFF and that the TURBINE BRAKE SWITCH (S1) is switched ON.
- d) Connect the output wires to the Voltage Limiter output terminals +VE and -VE observing polarity.
- e) Connect an electrical earth wire to the marked earth screw terminal provided.
- f) Separate the turbine wires and connect the turbine negative wire to the Voltage Limiter negative terminal. You may have to improvise by maintaining a short on the turbine wires as this connection is made.
- g) Finally connect the turbine positive wire to the Voltage Limiter positive terminal.
- h) Check that the turbine brake switch "S1" is ON and that the output circuit breaker "Q1" is off. (There is no reaction)
- i) Complete the external wiring to the charge controller or Grid Tie inverter. Follow the manufacturer's instructions for this work. Only after all wiring is complete and secure, the Voltage Limiter output circuit breaker may be switched on and the turbine brake switch switched off. Switch the turbine switch OFF.

The instructions are reversed for de-commissioning. First isolate the additional equipment, switch the Voltage Limiter output breaker OFF and then operate the turbine brake switch. A disconnected turbine should always be shorted.

4.4 Securing the Voltage Limiter

Always switch the turbine brake on (S1 ON) and the output circuit breaker off (Q1 OFF) before any maintenance or service

Remember to re-fit all covers and guards on all equipment installed before switching on.

NOTE: The Voltage Limiter controls high voltages and the internal components can cause a shock hazard. Be aware and consult a professional if you are in any way unsure.

5 Wire and Cable Sizes
5.1 Wind Turbine Wiring
5.2 Lightning Protection
5.3 Wire Tables

5 WIRE AND CABLE SIZES

5.1 Wind Turbine Wiring

Kestrel wind turbines produce dc power and output on two double insulated output wires (tails).

The RED wire is POSITIVE and the BLACK wire is NEGATIVE.

Observe the Polarity at all times. Only connect +VE RED cables to +VE RED terminals and -VE BLACK cables to -VE BLACK terminals. Otherwise, equipment damage may result and any warranty will be invalidated.

The following suggestions are made as a guideline. If you are in doubt, consult an electrician. The output wires must be extended as required for the installation. Choose the wire size that is suggested for the size of turbine, electrical current and the distance from the turbine to the charge controller. Good wire connections are absolutely essential to avoid poor power delivery and high temperatures at the connection. All electrical systems lose energy because cables have a resistance. The mounting structure must be directly earthed for lightning. The power cable is usually brought down the inside of the mounting structure to give some protection. Supply cables should never be spanned or suspended from the turbine structure and should be buried at least one half metre deep in a suitable plastic or steel conduit.

5.2 Lightning protection

Proper grounding is essential to protect the system from induced voltages and static. The installation must comply with local requirements for electrical installations. Ensure that the generator is electrically connected to the mounting structure and that the structure is earthed. This is usually done by burying a 2 to 3m (6' – 10') length of water pipe (steel or copper) horizontally, 800mm (2,5') below the ground surface. A good connection is made between the middle of the pipe and the structure. An improved method is to bury a cross of pipe, which requires an "X" shape to be excavated. The connection is made in the centre of the cross. The negative battery connection should also be grounded using a ground point close to the battery. The wire size for grounding should be the same size as the power cables. Commercial lightning arrestors are available at electrical stores and can be fitted at the bottom of the structure or pole or at the regulator input.

5.3 Wire Tables

The copper wire sizes given in the tables are calculated for 3% power loss in wire resistance. This is usually acceptable in low voltage installations. A larger wire size will increase the delivered power but usually a compromise is reached as larger cables cost more. It is recommended that the wire sizes given be taken as a minimum value.

Measure the distance from the top of your structure (i.e. the e150) to the Limiter. Select the wire size for that distance from the table. The double run of +ve and -ve is already accounted for.

The power cable should be run down the inside of the pole or structure and then buried in a suitable underground conduit at least 500mm below the ground surface.

Wire lengths account for a double cable run (both +ve and -ve together) being given in metric metres (m) and imperial feet ('). Wire cross sectional area is given in metric square millimetres (sq mm) and American Wire Gauge AWG.

Wire Size for 110V e150 (6,5A maximum current)

10m (33')	20m (66')	30m (96')	40m (130')	50m (165')	80m(260')	100m (330')
0,5sq mm (19)	1,5sq mm (16)	2,5sq mm (14)	2,5sq mm (13)	3,5sq mm (13)	5sq mm (10)	6sqmm(9)

Wire Size for 220V e150 (3,5A maximum current)

10m (33')	20m (66')	30m (96')	40m (130')	50m (165')	80m(260')	100m (330')
0,5sq mm (21)	1sq mm (18)	1sq mm (17)	1,5sq mm (15)	2,5sq mm (14)	3sq mm (12)	4sqmm(11)

6 TECHNICAL SPECIFICATIONS

General: Linear controlled voltage limiter to telecommunication specification with 600W capability for the overvoltage protection of suitable series connected charge controllers and gridtie inverters. Supplied to order for system voltages of 110Vdc and 200Vdc.

Controller Model	Rated Power	Maximum Current
Type 0602-600-135	600W	6,5A
Type 0602-600-245	600W	3,5A
Input voltage and variation	110Vdc nominal (135Vdc) 200Vdc nominal (245Vdc)	(0-400Vdc) (0-800Vdc)
Efficiency	>99% at full load	
Input frequency		N/A dc input
Input power factor		N/A dc input
Output Voltage (135Vdc) Factory set (no user adjustment)		135 - 126Vdc
Output Voltage (245Vdc) Factory set (no user adjustment)		245 - 220Vdc
Output voltage ripple		N/A
Output voltage regulation		12%
User control	Turbine brake and output isolate/circuit breaker	
User controls external		None
LED Indication		None
Cooling	Natural Convection with fan assist	
Mass		5,5 kg
Maximum Ambient		40°C
IP Rating		IP32
Cabinet Dimensions (wall mounting)		398Wx200Hx141D
Cabinet finish	Electroplated / white finish	
Certification	Complies with EMC requirements CIS22 Class B	10

7 TROUBLE SHOOTING

THE KESTREL TYPE 0602 VOLTAGE LIMITER MAY BE SERIOUSLY DAMAGED FROM POLARITY REVERSAL (wrong connection of +ve and -ve wiring). VOLTAGE LIMITER DEGRADATION CAN OCCUR FROM IMPROPER INSTALLATION CAUSING OVERHEATING.

IF FOR ANY REASON THE WIND TURBINE IS DISCONNECTED, SHORT THE GENERATOR OUTPUT WIRES. THIS WILL LOAD THE GENERATOR AND MINIMISE ROTATION.

- Q** The cooling fans never switch on.
A The turbine stop switch is ON. The fans are automatic and only operate when voltage limiting occurs.

- Q** The Output circuit breaker trips.
A There is a fault on the output cables. The output cables are reversed.

- Q** The Voltage Limiter is always working at a high temperature.
A The unit is diverting energy. The output circuit breaker has tripped. The charge controller or inverter has failed. The mains has failed (inverter only). Internal limiter components have failed.

- Q** Will I damage the Voltage Limiter if I disconnect the charge controller or the inverter?
A No, the Voltage Limiter will continue to control with no output connection. It may however become quite hot as it has to divert all the energy from the wind turbine. It is best to operate the turbine stop switch rather than have the controller working so hard for no reason.

8 MAINTENANCE

The Kestrel Type 0602 voltage limiter is designed for continuous operation on 100% duty cycle and requires no regular part replacement. Keep the unit clean and ensure that no foreign objects reduce the airflow through the bottom inlet grill or the top front outlet. Clean the case only with a soft damp cloth. Do not use any form of solvent.

This product controls and limits voltages that can cause a shock. Always take extreme care when the cover is removed. In the unlikely event of failure, the unit should be returned to the dealer or direct to the factory for repairs.

9 WARRANTY CONDITIONS

Kestrel's wind turbines and voltage limiters are manufactured to the highest standards, in accordance with Kestrel Wind Turbines' standard and quality specifications, and warrants that the voltage limiter is in good working order upon delivery and for a period of 24 months. Warranty terms and conditions are outlined below.

1. Eveready warrants that Limiters will, on delivery, be free of defects in design, material and workmanship and will be fit for their intended purpose for a period of two years calculated from the date of installation, subject to proper installation, maintenance and use in accordance with the User Manual.
2. This warranty is further subject to the Customer returning the defective Limiter at its cost to the premises of Eveready within the warranty period and furnishing full details in writing of the alleged defect or failure.
3. Eveready's obligations under this warranty shall be limited to the repair or replacement of defective Limiters at its cost or to a refund to the Customer of the original cost thereof, as Eveready may determine in its discretion. Eveready shall not be responsible for any damages suffered by the Customer pursuant to any defects covered by this warranty.
4. This warranty shall not apply to any damage to Limiters caused by winds exceeding 160 kilometres per hour or any other factors beyond the control of Eveready.
5. The Customer may purchase an extended warranty from Eveready in respect of Limiters, subject to Eveready's standard conditions.

CONTACT KESTREL WIND TURBINES

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Registration Number 2006/005438/07

VAT Registration Number 4870231406

Web: www.kestrelwind.co.za

NOTES

10 CUSTOMER FEEDBACK



Customer enquiry and feedback sheet Customer Information

Customer Name: _____

Postal Address: _____

Serial Number: _____

E-Mail Address: _____

Phone Number: _____

Fax Number: _____

Enquiry Details

Complete the form and submit to Kestrel Wind Turbines. Your feedback and queries are valuable to us.

Indicate your enquiry or feedback in the space provided below

For OFFICIAL Use Only

Date Replied: _____

Signature: _____

Comments: _____